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(54) IMPROVEMENTS IN BABIES NAPKINS

(71) We, THE BOOTS COMPANY LIMITED (formerly known as Boots Pure Drug Company Limited), a British Company of 1, Thane Road West, Nottingham, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The management of infants and others is frequently complicated by the incidence of a rash which is primarily due to the chemical irritation of the skin by ammonia liberated from urine and faeces in the napkin. A major cause of the ammonia in the discharge is degredation of urea in the urine by bacterial ureases produced by faecal organisms such as *Proteus spp.* which are usually present. The irritated skin is ideally suited to support secondary microbiological infections leading to severe irritation, pain and restlessness.

Attempts have been made to reduce the incidence of napkin rash by a number of methods, Thus one method is to treat the napkins during the laundering process with an antibacterial agent such as cetrimide or hexachlorophane with the intention of killing the bacteria which are already present on the napkin and the residuum of the agent left on the napkin is intended to suppress the bacteria when the faeces and urine are passed. Another method is to treat the napkins with vinegar in the final laundry rinse with the intention of absorbing the ammonia as it is formed. Boric acid has also been used to impregnate towel napkins but it is not as efficient absorbent for ammonia and furthermore its use in this manner has been highly criticised since boric acid can be extremely toxic when in direct contact with the skin. Yet another method is to treat the napkins with an anti-ureatic agent i.e. an agent which inhibits the action of the urease so that ammonia is not formed. For example, napkins have been treated with copper acetylacetonate. Such agents are sometimes used with various additives but in all instances the amounts involved are extremely small. For example, 0.15 mg copper acetylacetonate has been added to a 15 g napkin. A further method is to treat laundered napkins with an anti-bacterial agent. None of the methods has been widely adopted because either it is unsatisfactory or it is dependent on treatment in a commercial laundry.

We have now found it is possible to reduce or prevent the indicidence of napkin rash by using, as the baby's napkin, a napkin comprising a material that will absorb liquid and further comprising at least 2 grams of a monomeric organic acid having a pK value of from 1.8 to 4.5.

Such napkins form a part of the invention as also do various materials that may be used for the formation of such napkins, as described in more detail below.

The acid may be, for example, impregnated into or coated onto the absorbent material, it may be included in one or more water permeable sachets in the napkin, or it may be carried in or on a sheet carrier in the napkin. The sheet carrier may be a napkin liner, which may be of a permeable textile material, for example paper or other non-woven fabric, or some other paper sheet carrier may be used. for example as described below.

Suitable acids for use in the invention include citric, malic, tarturic, maleic, fumaric, malonic and succinic acids. The acids used in the invention should naturally preferably have a low vapour pressure so that unacceptable evaporation of them during use does not occur.

The urine and faecal discharge in soiled napkins normally contains up to 0.65% w/v of ammonia but when treated with urease the total ammonia content rises to an average of 1.2% w/v. This concentration of ammonia is the maximum which one would reasonably expect in practice. A soiled napkin which has

absorbed the average volume of 150 ml of urine may therefore produce up to 1.8 g of ammonia. The amounts of various acids required to neutralise the potential ammonia content of urine was found by titrating ammonia to pH 5.5 using a glass electrode pH meter and the results are summarised in the following Table.

Acid	Wt. of acid (g.) equiv. to 1g. NH_3 titrated to pH 5.5
Citric	4.2
Malic	3.4
Maleic	4.6
Malonic	3.6
Succinic	3.8
Tartaric	4.2
Fumaric	3.5

We prefer to use citric or malic acid as the ammonia absorber and we have found that in practice the incidence of napkin rash caused by the presence of relatively large quantities of ammonia is reduced by using substantially 4 g. of citric acid or 3.5 g. of malic acid with a napkin.

The time a soiled napkin is in contact with the skin will have some bearing on the incidence of napkin rash and in laboratory experiments it was found possible to prevent the evolution of ammonia over a period of 6 hours, during which period the napkins were lightly pressed occasionally, by treating the napkin with only 2.5% w/w of malic acid based on a 20 g. napkin.

The optimum amount of acid naturally depends upon the particular acid being used. Usually there is at least 3 grams of the acid, and often 4 grams or more.

A baby's napkin in use is generally substantially rectangular in shape with one side about $1\frac{1}{2}$ to $2\frac{3}{4}$ times the length of the other side. Thus the long side may be from 20 to 40 centimeters, preferably 25 to 35 centimeters while the short side may be from 10 to 25 centimeters, preferably 15 to 20 centimeters. Often the size is 30 centimeters by 18 centimeters. Accordingly if the baby's napkin carries 2 grams of the acid this is equivalent to about 40 grams per square meter, the area being the surface area of one side of the napkin when in use. Of course if the napkin is made by folding material to form the desired napkin then the concentration per square meter of the larger material will be less. An amount of 3 grams of the acid is equivalent to an amount of about 60 grams per square meter of napkin area. By using the amounts of acid indicated it is possible substantially to eliminate the evolution of ammonia collected in the napkin during normal usage over a six hour period.

One type of napkin according to the invention is a towel napkin, the towel being impregnated with the acid. Usually the towel has to be reimpregnated with the acid after each washing, and this is a disadvantage. The towels may have a surface area of up to 0.8 square meters, for example they often measure 60 x 60 cm. They may be impregnated with an aqueous solution of malic acid or other acid to deposit at least 2 grams and preferably 3 to 4 grams of acid, per napkin.

In another napkin a disposable absorbent material is used, the napkin then being a disposable napkin. The disposable material may comprise a sponge but generally is a textile having a non-woven base that generally consists of or contains a large proportion of cellulose fibres and is generally referred to as cellulose wadding. In such a napkin the wadding is generally 3 mm thick and usually 5 mm or more. The wadding may be reinforced on at least one side but usually is reinforced on both sides and in fact may be located in a reinforcing envelope. The reinforcement may be integral with the fibrous base, this being achieved for example by bonding the surface or surfaces of the wadding and then applying reinforcement. The reinforcement may for example be a net. Preferably there is a net on both sides of the napkin. In the production of such napkins any reinforcement may be applied to the textile base after the base has been formed into the desired shape or the reinforcement may be present on a textile base that is to be cut to shape to form the napkin. For ex-

ample a napkin according to the invention can be made by cutting the desired length from a continuous sheet, usually a continuous roll, of wadding that is at least 3 mm thick and which is from 10 to 40 cm wide and which comprises at least 40 grams per square meter of the specified acid.

The acid may bean integral part of the absorbent material, for example having been impregnated into the material or coated onto it, or it may have been dispersed in granular form throughout the material.

In another form of napkin according to the invention the acid is carried in or on a napkin liner. Such liners are intended to allow the urine to pass through to an absorbent material, e.g. towelling, behind them. The liners are generally fairly thin permeable textile sheet materials and may be woven, knitted or, most usually, non-woven. They may be, for example, less than 1 mm thick and are often of cellulose fibres. They may have the size of the napkin, for example from 20 to 40 centimeters by 10 to 25 centimeters but usually are not more than 25 x 25 centimeters. When present as individual pieces of such a size they will each comprise at least 2 grams of the acid specified. However the liners may be produced in continuous lengths, for example rolls 10 to 25 centimeters wide and comprising at least 40 grams per square meter of the acid.

In another napkin according to the invention the acid is carried on a base material in strip or sheet form and this can, for example, be inserted between a napkin liner and absorbent material or in a pocket or folds in a towel napkin. Such strips or sheets may also be incorporated in disposable napkins and facilitate the manufacture of the finished product incorporating the acid. They may also be integrated with napkin liners. The strips can be formed by cutting to a desired length a continuous roll of material which may be a woven, knitted or non-woven material from 1 to 25 centimeters wide and comprising at least 40 grams per square meter of the acid. The material is preferably a paper, for example being made mainly from short cellulose fibres, e.g. less than 10 and preferably less than 5 millimeters in length, generally by a process in which water is drained from an aqueous slurry of the fibres on a screen. The material is usually thin, e.g. less than 1 mm thick.

Thin material carrying the acid may be combined with thicker absorbent material at any stage in the manufacture of the napkin. For example a continuous sheet of wadding may have paper carrying the acid continuously laid against it or the wadding may be continuously formed around the thin material and the resulting laminate cut to desired shape subsequently or wadding and the thin material may be cut to shape and then laid together.

When the acid is distributed over paper that is within the final absorbent article, as opposed to being a liner, this paper is generally present primarily to provide the acid. The paper may be substantially coextensive with the main absorbent e.g. the wadding of the article or it may cover some areas only of the wadding or other absorbent material. Thus the paper may be in the form of narrow strips which are laid against or into the wadding. For example the paper may be in the form of a strip from 1 to 25 cm. wide.

It is particularly preferred that the housewife should be able repeatedly and easily to produce napkins that are capable of absorbing ammonia and this can be achieved by providing the housewife with a roll of the paper carrying the acid with the result that she can tear off a suitable length of paper to prepare each napkin or to provide her with a container, e.g. a box containing interleafed sheets of the paper.

The acid may be incorporated with the absorbed material of the napkin, a napkin liner or other sheet carrier in any convenient manner. For example acids that are soluble in water or other convenient solvents may be impregnated as a solution into absorbent sheet carrier, optionally as the last stage in the manufacture of the carrier which is then dried to give a uniformly impregnated material. For example, aqueous solutions of citric or tartaric acid may be used. It may also be coated onto the material.

In another napkin according to the invention the acid is sealed in a water permeable sachet formed from, for example, polyvinyl alcohol. Such a sachet may be inserted for example in a pocket or within the folds of a napkin or it may be incorporated within an absorbent napkin.

It is to be understood that the acid may be used in conjunction with the other additives for reducing napkin rash e.g. bactericides and enzyme inhibitors which are pharmaceutically acceptable and also compatible with the ammonia absorbers. Typical of such bactericides are phenylmercuric salts such as phenylmercuric nitrate and phenylmercuric acetate. Bronopol has also been found to be useful in conjunction with e.g. malic or citric acid and the amount of acid may be reduced. Bronopol is 2 - bromo - 2 - nitropropane-1,3 - diol.

In constructing a napkin from an absorbent material containing the acid, it is of course necessary to consider the dermatological effect of the particular agent being used. It is preferred that the acid should be dermatologically acceptable, that is to say that is should be non-irritant and non-toxic both in solid form and solution but it is adequate in most constructions of napkins if it is merely dermatologically acceptable in solution in urine. Thus if it is dermatologically unacceptable and is enclosed in a water soluble sachet or absorbed

in a strip of paper it will only come into contact with the skin when in solution after absorbing ammonia and this would be satisfactory.

The following non-limitative examples illustrate the invention:—

Example 1

A rectangular portion of cellulose wadding (20 g.; 30 cm. x 18 cm.) was treated with a solution of citric acid (4 g.) in isopropanol and dried. The treated wadding was covered with a 30 cm. x 18 cm. rectangular piece of cotton wool (5 g.) and used as a disposable napkin with the cotton wool in contact with the skin. Similar napkins were prepared using water or ethanol as the solvent for the citric acid.

Example 2

Disposable napkins were made in a similar way to that described in Example 1 but using tartaric acid (4 g.), malic acid (3.5 g.) or fumaric acid (3.5 g.) to impregnate the cellulose wadding.

Example 3

A disposable napkin was prepared from a rectangular portion of cellulose wadding (20 g.; 30 cm. x 18 cm.) and above the wadding was placed at equal distances four strips of absorbent paper 25 cm. x 2.5 cm., each strip being impregnated with an aqueous solution of malic acid so that each strip contained 1 g. of acid. The absorbent wadding and treated strips were enclosed in a fabric envelope and when treated with 100 ml. of artificial urine containing urease the evolution of free ammonia was prevented for a period in excess of 6 hours.

Example 4

A disposable napkin was prepared from a rectangular portion of cellulose wadding (20 g.; 30 cm. x 18 cm.) and above the wadding was placed at equal distances four strips of absorbent paper 25 cm. x 2.5 cm., each strip containing 0.5 g. of malic acid and 0.625 mg. of Bronopol. The absorbent wadding and the treated strips were enclosed in a fabric envelope.

Example 5

A continuous length of absorbent paper was impregnated with a solution of malic acid and Bronopol at a rate of 66 g/m² malic acid and 83 mg/m² Bronopol, and was dried. Parts of this were treated in different ways. One part was cut into sheets 20 cm. x 15 cm. which were interleafed and packed in a box. One part was cut longitudinally into strips 20 cm. wide and perforated every 15 cm., each strip then being wound as a roll. Another part was cut into strips 2.5 cm. wide, part of this then being cut into 15 cm. lengths and part being wound on a roll.

One napkin can be made up using 6 of these strips 2.5 cm x 20 cm. Thus they may be placed in the folds of an ordinary towel napkin or in a specially prepared pocket therein, or they may be placed between a napkin liner and a napkin or they may be attached to a napkin liner for use in conjunction with a napkin or they may be incorporated in a disposable napkin.

Example 6

2 g. of malic acid and 2.5 mg. of Bronopol were enclosed within a sachet made from polyvinyl alcohol. This sachet was placed in the folds of a towel napkin. In place of the 2 g. of malic acid and the Bronopol there was also made a sample comprising 4 g. of malic acid. Citric acid could be used for these examples in place of the malic acid.

WHAT WE CLAIM IS:—

1. A baby's napkin comprising a material that will absorb liquid and further comprising at least 2 grams of a monomeric organic acid having a pK value of from 1.8 to 4.5.
2. A napkin according to claim 1 in which the material that will absorb liquid is towelling.
3. A napkin according to claim 1 in which the material that will absorb liquid is cellulose wadding at least 3 mm thick.
4. A napkin according to any of claims 1 to 3 in which the acid is impregnated into or coated onto the material that will absorb liquid.
5. A napkin according to any of claims 1 to 3 in which the acid is in or on a sheet carrier.
6. A napkin according to claim 5 in which the sheet carrier is a napkin liner.
7. A napkin according to claim 5 in which the sheet carrier is paper.
8. A napkin according to any of claims 1 to 3 in which the acid is in a water permeable sachet.
9. A napkin according to any preceding claim in which the acid is citric acid, malic acid, maleic acid, malonic acid, succinic acid, tartaric acid or fumaric acid.
10. A napkin according to any preceding claim additionally comprising a bactericide.
11. A napkin according to claim 10 comprising as bactericide, 2 - bromo - 2 - nitropropane - 1,3 - diol.
12. A baby's napkin formed of cellulose wadding and comprising substantially 4 grams citric acid.
13. A baby's napkin formed of cellulose wadding and comprising substantially 3.5 grams of malic acid.
14. A baby's napkin according to claim 1 substantially as herein described with reference to any of the Examples.
15. A sheet carrier suitable for use as a napkin liner in a napkin according to claim

5 and comprising a permeable textile base less than 1 mm thick and having one dimension of from 20 to 40 cm and the other dimension of from 10 to 25 cm and comprising at least 2 grams of a monomeric organic acid having a pK value of 1.8 to 4.5.

16. A sheet carrier suitable for use as a napkin liner in a napkin according to claim 5 and comprising a roll of a permeable textile less than 1 mm thick, the roll being from 10 to 25 cm wide, and comprising at least 40 grams per square meter of a monomeric organic acid having a pK value of from 1.8 to 4.5.

17. A continuous roll of cellulose wadding suitable for use as a napkin according to claim 3, the roll being from 10 to 40 cm wide greater than 3 millimeters in thickness and comprising at least 40 grams per square meter of a monomeric organic acid having a pK value of from 1.8 to 4.5.

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